Master's Thesis

Regional Disparities of Health Status in Korea: Findings From KNHANES(2007-2014)

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Abstract

Health disparities are a major field of research that has long been addressed in many countries, as there were relative differences in the benefits of activities to improve health. Researches have been conducted on the disparities in health status among the regions, as the physical environment surrounding individuals also affects health level differences. Most previous studies have analyzed the disparities in health status between urban and rural areas, and studies on US have shown that rural health is better than urban. In Korea, however, previous studies have shown inconsistent results. Therefore, in order to understand the reason for the difference between the results of the researches in Korea and US, this study classified the regions based on the characteristics of the region in Korea and analyzed disparities in health status among regions. Furthermore, we analyzed how the level of health varies between regions according to low income and high income class with hypothesis that the difference in health level among regions become more apparent in specific income.

Based on data from Korea National Health and Nutrition Examination Survey (KNHANES) for a total of 8 years from 2007 to 2014, prevalence of chronic disease, obesity and depression among regions were analyzed on 34,303 samples. The residential area variables of the study were established by regional classification derived from cluster analysis with factor score which are results of factor analysis performed based on the physical environment and industrial characteristics. This study analyzed distribution of socio-demographic characteristics, health behaviors, and health status among regions using chi-square. In addition, logistic regression was also performed to analyze differences in health level between regions with controlling variables.

The results of the study showed that the incidence of disease was low in aged rural regions, fishing regions, and rural - urban integration regions compared to CBD regions by controlling individual characteristics. These results were much clearer in the analysis of the low income class, especially on the aged rural regions. In addition, these results in this study were more detail than result of previous literatures to use simple urban and rural classification.

This study examined hypotheses that there would be a difference in health level according to region derived from cluster analysis and these results were different from the results of US. This is because the regions classified in this study reflect the characteristics of Korea where various population lived in a single administrative district. This study suggests the necessity of reflecting the characteristics of Korea different from the US in analyzing the difference of regional health level in Korea.

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I. Introduction

1.1 Background

As people have been focused on health problem, the interest on improving health status and well-being has increased. Thus, people have tried to improve the health status, which lead to increasing overall person's health. In the developed countries, since the 1980s, health promotion goals have been established and the national health promotion campaign has been carried out due to the entry into the aged society and the increase in chronic diseases. In detail, there are 'Healthy People 2000' and 'Healthy People 2010' in United States, National Health Care Movement', 'Healthy Life 80 Health Plan' and 'Health Japan 21' in Japan, 'Better health commission' Australia and so on. In Korea, Health Plan 2010 was established to establish a lifelong health management system for each lifecycle. (Kim & Jung, 2009; KIHASA, 2005).

Despite these efforts in each country, these benefits were relatively different in socio-economic class and regions, leading to the issue of health disparities(Lee, 2005). This condition was defined as health disparity which means unnecessary, avoidable and unfair inequality between population or region(WHO, 2010) or structural difference and disparity to solve with political and institutional effort(Yoon, 2010). This can lead to the burden of medical expenses and shortening the life span in perspective of individuals depending on socioeconomic conditions, and may lead to an increase in the cost of health insurance and pass down national health inequality in a generation(Ko, 2010).

In order to reduce the health disparity, researchers conducted study related to the disparity in social-economic status in the early part (Kim, 2005; Lee, 2005; Kim, 2016; Jeon, 2016; Kim et al., 2010; Hwang & Shon, 2016). They presented there was disparity in health behavior depending on the social class, which had implication to show effect of social structure on person's health(Ko, 2010). Furthermore, the studies related to regional health disparity has been conducted with increasing interest about external health determinant as well as individual health determinant(Lee, 2016). These studies on regional health disparity were focused on health difference in rural and urban area, while the population and infrastructures for health promotions has been concentrated with urbanization and industrialization.

According to previous studies, the results of regional health disparity were different depending on data source, health status index, method, and study scope. However, researches in the United States presented that overall health behaviors and status of rural residences were worse than urban residences. On the other hand, in Korea, results of research presented that there was no statistically significant difference in health status between urban and rural or there were some results which weren't consistent with results of US cases. They showed some different results between Korea and US although previous

studies analyzed health disparity between urban and rural with similar hypothesis. Previous studies on Korea distinguished urban and rural area based on administrative districts like the studies on US. However, Jung & Cho(2005) suggested that administrative unit in Korea didn't reflect the directly or indirect influences on lifestyle of residences, the physical or social uniqueness like the West. Thus, they suggested complex process was needed to define the regions in studies related to the health because Korea. In addition, the comparison study of rural health level in urban areas has limitations in deriving only simple comparison results and in understanding the causes of specific inequalities.

1.2 Purpose

The purpose of this study is to analyze health disparity by regions focusing internal injuries such as chronic disease, obesity and depression from Korea National Health and Nutrition Examination Survey (KNHANES: 2007-2014). In approaching the regional health disparity, most of researches were divided into urban and rural areas using administrative districts and analyzed health disparity. A simple regional classification does not adequately reflect the surrounding environment of the local residents, and the health level may be underestimated or overestimated. Thus, this study classified the regions using cluster analysis and analyzed disparity in health status unlike previous literatures. Based on regional classification this study compared prevalence of internal injuries between various regions and central business district. Finally, we examined the health disparity depending on income class to understand the specific aspect of regional health disparity. This is because, it is one of the important factors in the spatial distribution or access to medical services. The research question for this is as follows.1) Is there health disparity in each internal injury by regions? 2) What are the prevalence of each disease in other regions compared to urban areas? 3) What are the regional health disparity depending on income referred to urban area?

For the purpose of this study, the paper is composed as follows. First, we introduce the background and purpose of this study. Second, we reviewed framework health disparity and study for regional health disparity on Korea and West. Third, the variables are shown based on literature review. In addition, we explained the method for regional classification and analysis of health disparity. Fourth, the results of analysis were provided and interpreted by being comparing with U.S. results. In this step, we offered the descriptive statics and interregional health disparity without control variables. Using multivariate logistic regression, we analyzed only effect of regions on health disparity. Furthermore, regional health disparity was analyzed depending on income class. Finally, we concluded the health disparity status in South Korea based on new regional classification. Through this, we suggest the implication on public health and limitation of this research.

II. Literature Review

2.1 Concept Framework of Health disparity

Although health status and life expectancy has improved with economic growth in many countries, there has been disparity in socioeconomic areas such as income, education, employment, and regions, which has worsened health disparities (Lee, 2005; Kwon et al., 2015; Lee, 2016; Norbury et al., 2011; Rainham, 2007). According to International Society for Equity in Health, health disparities defined that there is a systematic and potentially improbable difference in one or more health aspects between population groups that are socially, economically or geographically separated(Ko, 2010; Choi, 2015; KIHSA, 2013). That is, health disparity was structured from traditional social disparity factors(social class, race, gender and residence area) that differentiate opportunities on medical service and quality of individual health life(Link & Phelan, 1995; House, 2001; Ko,2010). The concept of health disparity varies depending on application fields such as health, social, political and urban planning(Carter-Pokras & Baquet, 2002; Kwon et al, 2015; Lee, 2016). Generally, it is recognized as results of difference in socioeconomic capacity such as income or status.

Especially, the study on health disparities is related to the expansion of health concept which lead to question about determinants to affect health. Thus, researchers considered various factors to affect health level from individual characteristics to environmental context(Kim, 2016). Beyond the dictionary meaning of health disparity, WHO Commission on Social Determinants of Health (2010) suggest that "conceptual framework on social determinants of health" to define complex factors which affect health status. This consists of two parts; 1) structural determinants including socioeconomic and political context and socioeconomic position, 2) intermediary determinants including built environment, behaviors factors, psychosocial factors and health system. In detail of Commision on Social Determinants of Health of World Health Organization(CSDH) framework, the socioeconomic and political context affects socioeconomic position which is individual characteristics including occupation, level of education and income, racial and so on. Next, the socioeconomic position determines the final health status or health equity to affect intermediary. Finally, health status or equity has influence on structural determinants like feedback process. It explains that mechanism to produce interregional health disparity is represented not only by individual dimensions but also by causal relationships among various factors surrounding individuals. In this perspective, the socioeconomically vulnerable participants were discriminated against environment and access to the public service for good health status. WHO CSDH insisted that we consider that slope of overall health disparity by being focused on social determinants of health.

As the interest in regional health inequalities due to external health determinants surrounding individuals increases beyond socioeconomic characteristics, researches on the health level of the region have become active mainly in developed countries.

2.2 Research on the health disparity in US

Since 1980s, research on health disparities has emerged as a major issue in health policy centered on developed countries. The research on the health inequality was not limited to the determinants of individual health, but has begun to pay attention to the external health determinants such as the environment surrounding the individual. Especially, researchers thought that there is health disparity in rural and urban area due to regional imbalance derived from difference in lifestyle, environment and economy(Jun et al.,2002). According to health disparities: rural-urban Chartbook(2008) that showed the overall disparity in health and health behaviors between rural and urban area. This book explained risky health behaviors of rural residences is based on rural culture health determinant. This presents rural residences have not only worse smoking and diet habit and less physical activities but also have higher the prevalence of obesity and diabetes than urban residences(Bennett, Olatosi, & Probst, 2008; Hartley, 2004). In addition to this literature, studies related to the health disparity are conducted by using various health status index such as chronic diseases, obesity and depression etc with rural-urban dichotomy(Hartley 2004; Bennett, Olatosi et al., 2008; O'Connor & Wellenius 2012; Krishna et al., 2010; Weaver et al., 2013; Davis et al., 2011)

Bennett et al.(2011) introduced that obesity is influenced by the individual's life pattern and eating habits mediated by the environment and obesity become the risk factor of chronic disease(Feng et al., 2010; O'Connor & Wellenius, 2012; Eberhardt & Pamuk, 2004). In particular, people in poorer regions have poor chances of eating good or nutritious food, which is risk factor on their health condition. Thus, Rural areas have a high risk of obesity due to their personal characteristics and surrounding environment (Lovasi et al., 2009; Patterson et al., 2004; Wang et al., 2007; Jackson et al., 2005; Bennett et al., 2008). In detail, previous literatures have used the surveys conducted at the county level(Befort et al.,2012; Bennett et al., 2011; Eberhardt & Pamuk, 2004; Patterson et al., 2004), community level(Hill et al., 2014),and state level(Jackson et al., 2005). For analyzing health disparities in urban and rural using various code such as Urban Influence Codes(UIC), FIPS, RUCA and metropolitan statistical area were used to divide regions into urban and rural area.

In case of obesity, they focused on adults and presented that the prevalence of obesity in rural area was higher than urban area(Befort et al., 2012; Bennett et al., 2011; Jacksone et al., 2005; Davis et al.,

2011; Patterson et al., 2004; Jeons-Matre et al., 2008, Bennett et al., 2008). These results were derived from model controlled by individual characteristics. They suggested various reason on results of health disparity in obesity. Jackson et al.(2005) discussed that the chances of obtaining health-related knowledge are low because of the low educational level in rural area. Other studies have claimed that rural residents are more likely to be obese than urban because their health-related physical activity and eating habits are less or worse than urban areas (Befort et al., 2012; Davis et al., 2011; Patterson et al., 2004; Bennett et al., 2008; Jeons-Matre et al., 2008). Among them, Befort et al.(2012)explained additionally automation of the farm machinery to the cause of lack of activity. The others have linked the physical environment to why rural areas are more obese than urban areas (Bennett et al., 2011; Patterson et al.,2004; Davis et al., 2011). In detail, Bennett et al.(2011) claimed that rural area had limitations in eating or accessing healthy food due to lack of food-related infrastructures. Patterson et al.(2004) discussed that people who lived in rural area exposure to inactive for leisure due to lack of place for exercising. Davis et al.(2011) explained that rural area lacked health care-related facilities and resources compared to urban. Although Hill et al.(2014)showed that disparity in prevalence of obesity between urban and rural wasn't statistically significant, they showed additionally the result that exposure to rural environment would increase disparity between urban and rural.

In addition to obesity, previous literatures focused on chronic diseases, physical activity(Hill et al., 2014; Fan et al., 2014; Bennett et al., 2008), self-reported health(Weaver et al., 2013), mental health(Baernholedt et al., 2011; Probst et al., 2006) and mortality(Eberhardt & Pamuk, 2004) . In detail, previous literature showed rural residences were more likely to prevalent chronic diseases compared to urban area(Bennett et al.,2008; Ebhrhardt & Pamuk,2004; O'Connor & Wellenius,2012; Krishna et al.,2010). O'Connor & Wellenius(2012) claimed that infrastructures in rural area was more limited to exercise, select good quality and healthy food and access to medical service for reason of poor rural health. Krishna et al.(2010) also insisted that residence in rural have increased the barriers to receiving medical services due to lack of infrastructures. The other literatures suggested the reason for health disparity among rural people in relation to health behavior of individuals(Bennett et al., 2008; Ebhrhardt & Pamuk, 2004). In case of other health outcomes, previous literatures showed health condition in rural area were worse than urban area. For this result, Weaver et al.(2013), who studied the self-rated health status of cancer survivors, claimed that treatment and health cares in rural area were not as good as urban areas and people had worse mental health. Baernholdt et al.(2011) suggested that rural residents have difficulty to from social capital due to the lack of transportation service to meet other people.

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2.3 Research on the health disparity in Korea

The difference in health level between urban and rural areas in Korea has been active since 2000s. Studies on the difference of health level in Korea focused on the health inequality between social classes in the early stage. While people pay attention to external health determinants, the research focus on regional health inequalities. The difference in health level between urban and rural areas in Korea showed overall inconsistent results. US studies also used a variety of methods and data sources, but overall results presented poor health in rural areas. In Korea, to study the health disparity, the local classification standard was used for the administrative districts such as eup·myeon·dong or si·gun·gu. Eup or si was classified into urban area and myeon·dong or gun·gu was classified into rural area. Most of researches in Korea compared the regional health disparity with adults (Lee et al.2005; Lee, 2005; Jeon et al., 2016; Lee, 2016; Yoon & Kim, 2006; Park, 2012; Ko, 2010; Choi, 2016; Lee, 2010) or elderly people (Chun et al., 2013; Jeon et al., 2002; Kim & Jeong, 2009; Lee and Lee, 2012).

In addition, many researched selected chronic disease as outcome in study. They presented inconsistent results on health disparity between rural and urban area. Both the national study and the study in the specific area presented there was no difference in health level among the regions (Lee et al., 2005; Jeon et al., 2016; Lim et al.,2012). Lee et al.(2005) and Lim et al.(2012) claimed that individual characteristics were more likely to affect prevalence of chronic disease than regional characteristics for reason of result. Jeon et al.(2016) presented additionally urban poor participants has worse environment than rural. Thus, they discussed that policy makers and planners for public health had better consider the urban poor groups. Other researches showed consistent results with US studies(Lee, 2005; Lee, 2016; Yoon & Kim, 2006; Jeon et al.,2002). They suggested that reason on results is due to the lack of medical resources in rural areas than in urban areas. Additionally Yoon & Kim(2006) claimed that people in rural areas are exposed to structural causes such as pesticide hazards, alcoholic middle eastern hazards, and so on. On the other hands, some researched presented that the prevalence of chronic disease in rural was less than urban(Lee et al., 2010; Lee and Lee, 2012; Chun et al.2013). Especially, Chun et al(2013) used KNHAHNES data and presented opposite results of research on US. They suggested various reasons on results. First, the health behaviors and mental health status of rural elderly people were better than urban area. Second, people with the disease may have moved to the city where their offspring were. Third, the elderly who were in serious health conditions may have already died, having a low prevalence level.

In addition to chronic disease, Choi(2016) research health disparity in cancer mortality between rural and urban area. He showed that total cancer mortality in rural was higher than urban area due to inconvenience physical accessibility to cancer care services. This research discussed that rural area has

small hospitals and primary medical facilities not to investigate cancer. Park(2012) studied disparity in mortality between urban and rural. She also presented that mortality in rural was higher than urban and discussed reason that regional health disparity was derived from difference in local infrastructure and local member. In addition, Self-rated health was also selected as outcome in studies. They showed that self-rated health in rural area was worse than urban(Lee et al., 2005; Lee, 2005; Lee, 2016; Yoon & Kim, 2006; Ko, 2010).

Previous literatures presented inconsistent results on health disparity between urban and rural. In particular, researches on Korea showed consistent or different results from US. To understand these results. I wonder why the results of health disparity in rural and urban areas in Korea differ from those in North America. Thus, I think that study on deeper understanding of the situation in Korea is needed. However, urban and rural classification in previous literature was simple and rough to identify the cause of difference. Korea had a diverse range of people living in a single administrative district, and diverse cultures coexist. As a result of these characteristics, if study simply classify a region as if research on US are a city or a rural area in the United States, the difference in health level caused by the structural causes of the region can be underestimated or overestimated.

For this reasons, this study classified the regions that can distinguish the regions by demographic and physical characteristics and analyzed whether there are differences in health level among the regions. Furthermore, we want to analyze how the difference in income level in each region differs from region to region. Previous literatures related to the regional health disparity classified the regions by using simply administrative units. Simple classification has limitation not to consider regional characteristics. It is highly likely that it will create an inappropriate policy because the understanding of the regions is low. Thus, the classification help people understand regions and to consider various aspect(Song & Knaap, 2007). There are few studies to compare the health status according to the physical and social characteristics of the area. Therefore, this study analyzed the health disparity of Korean adults between regions derived from cluster analysis using the 2007-2014 National Health and Nutrition Survey data.

III. Research Design

3.1 Study scope

For analysis about overall health disparity, the data used in study came from Korea National Health and Nutrition Examination Survey(KNHANES). This survey consists of health survey, health examination and nutrition survey. Among data, we selected adults as the object of study because the physical activity and contents on disease is reported and interviewed from over 20 years old.

The spatial scope of this study is all regions of South Korea to analyze the overall health disparity by regions. Before exploring relationship between regions and prevalence of chronic disease, we collected and analyzed data at unit of eup·myeon(twon)·dong(neighborhood) which is smallest administrative units within range acquiring data. The reason is that the interregional health disparity shows a tendency to become larger as it goes down lower administrative units (Yoon, 2011). In addition, data of KNHANES are offered as unit of relationship.

The temporal scope of this study is total 8 years from 2007 to 2014 because KNHANES data was used cumulatively from 2007 to 2014. As regional classification was used in analysis of health disparity, we established and analyzed built environment and demographic data only in 2010. Although data aren't collected by considering change of built environment, base year minimized the error drawn from the discrepancy of period between data of KNHANES and data for regional classification.

3.2 Data and Measurement

a. Factors for regional classification

For regional classification, the demographic and built environmental factors to represent characteristics of urban and rural are collected with eup·myeon·dong as unit based on previous literatures(Dauh & Park, 2000; Lee, 2002; Yim, 2005; Lee & Lee, 2011; Kim et al., 2014; Song & Knaap, 2007; Seong & Song, 2003). As the regional classification is used for analysis of health disparity as regional variable, the period of data is focused on 2010. When it is difficult to collect data of 2010, they are collected with most close year. In case of built environmental factors, variables are established as eup·myeon·dong as unit. First, residents varied widely by regions, demographical factor is considered as primary category for regional classification. In detail, the demographical measures include the aged-child ratio. These data came from '2010 Population and Housing Census' and calculated by dividing number of over 65 years old people by number of under 15 years old people.

Table 1. Variables for factor analysis

Variables			unit
Demographical		Aging index	%
Industrial structure		Farming household	ratio
		Farmer with a side job	ratio
		Full time farming household	ratio
		Fishing household	ratio
		Fisher with a side job	ratio
		Full time fishing household	ratio
		Service employment	ratio
		Manufacturing employment	ratio
Built environment	Land cover	Forest area ratio	ratio
		Urbanization area ratio	ratio
		Agriculture area ratio	ratio
	Density	Population density	person/m2
		Office building density	ratio
		Commercial building density	ratio
		Apartment density	ratio
		Road density	ratio
		Building density	ratio

To classify urban, rural or fish village, we used the ratio of full time farm household, farmer with a side job, full time fishing. These variables are drawn from the rural-urban dichotomy approach that rural is different community from urban with nature environment and socioeconomic aspect(Yim, 2005). These data also came from the 'Agricultural and fishery Census' by Statistics Korea. The ratio of total

farmer or fishing household is calculated by dividing number of farm or fishing household to total household of regions. Other variables are calculated divided to number of farm or fishing household as denominator. In addition to index related to the primary industry, ratio of manufacturing industries employment, and service industries employment from National Industry Survey. Each ratio is calculated by dividing number of employment to total number employment.

The built environmental factor consists of density and land use largely. Density include population density, apartment density, total building density, commercial building density, business office building density, road density, apartment density. Population density was measured from 2010 Population and Housing Census. The others were calculated by using building footprint area come from National road address data. In case of land use the data came from land cover map from Environment Spatial information services. We used the large category of land cover made at the end of 2010. This map consisted of 7 categories which are urbanization, agriculture, forest, grassland, wetland, barren ground area and waters. Among them, we used urbanization, forest and agricultural area and calculate ratio by dividing them by administration area. land use (forest, farm, and urbanization) ratio and mountainous regions. We used ArcGIS 10.4.1 for measuring built environmental factors.

b. Data source for health disparity analysis

Sample

Korea National Health and Nutrition Examination Survey(KHANES, 2007-2014) is conducted by Korea Centre for Disease Control and Prevention at all regions of South Korea since 1995. Samples of KHNANES are extracted by using multi-stage systematic sampling designed with Population and Housing Census. In KNHANESⅣ (2007-2009)[1], 4000 households are surveyed in 200 primary sampling units(PSU) during one year. In KNHANESⅤ(2010-2012)[2] and Ⅵ(2013-2015)[3], 3800 household in 192 PSUs participated in survey. The KNHANES excluded residents of nursing homes,

[1] The Forth Korea National Health and Nutrition Examination Survey (KNHANES Ⅳ), 2007-2009, Korea Centers for Disease Control and Prevention

[2] The Forth Korea National Health and Nutrition Examination Survey (KNHANES Ⅴ), 2010-2012, Korea Centers for Disease Control and Prevention

[3] The Sixth Korea National Health and Nutrition Examination Survey (KNHANES Ⅵ-1,2), 2013-2014, Korea Centers for Disease Control and Prevention

military facilities, prisons and so on from survey in all stages. However, stratification standards have changed slightly in accordance with the stage.

The fourth (2007-2009) survey population was defined as all the households in the 2005 Population and Housing Census results. The 2005 Population and Housing Census population and household information data were used as extraction frame. It was divided into 29 strata considering eup·myeon·dong, housing type and housing type in the whole country. 200 eup·myeon·dong were extracted by using proportional allocation to match the proportion of population with the sample composition ratio in each stratum. In the selected eup·myeon·dong, the houses were sampled one by one to second phase, reflecting the characteristics of each house type. In the selected sample, 20 ~ 23 houses were sampled by the system extraction method to third phase.

In case of fifth(2010-2012) survey population were defined in the tong·ban·li of resident population in 2009 and the apartment survey district was extracted from the apartment complex survey area of apartment market data. The sampling area was the first stratification by provinces (Seoul, 6 metropolitan cities, Gyeonggi, Gyeongsang, Gangwon, Chungcheong, Jeonla and Jeju). 26 strata were extracted based on population ratio, sex and age groups in general area to second phase. Apartment area extracted 24 strata based on price per square meter and average square meter on same phase with general area. In the sampled area extracted, 20 final surveyed households were extracted by the systematic sampling method.

In case of sixth(2013-2015), the second stage stratified sampling method was used to select the survey target. Based on the first stratification standard (si·do, eup·myeon·dong and housing type), the second stratification standard (residential area ratio), and the intrinsic stratification standard, total 576 survey area were extracted. For households with the second extraction unit, 20 households were selected from the appropriate households in the sampling area using the systematic extraction method.

It consists of health survey, health examination and nutrition survey. In detail, the health survey is composed of household survey, health interview and health behavior. Household survey and health interview are conducted by trained medical staffs. Research targets reported smoking, drinking alcohol and physical activity themselves. Health examination include the overall physical information such as height, weight, and so on. Nutrition survey consists of eating habits of reporters and 24housr survey information. For analysis of health disparity, we focused on adults which are over 19 years old and select the 34,303 samples.

Dependent variable

For comparison analysis between regional health status and behaviors, the dependent variable consists of prevalence of chronic of internal injury. Internal injury includes chronic disease as well as depression and insomnia belonging to mental illness. Prevalence of chronic disease including diabetes, hypertension, hyperlipidemia, arthritis and cardiac disease was categorized into yes and no. In detail, prevalence of hypertension, diabetes, and hyperlipidemia is categorized from the diagnosis and result of health examination. The other diseases were used on only diagnosis. In case of obesity, person who has over 25kg/m^3 was categorized into over-weight and the others were categorized into norm

Independent variable

Independent variables included socioeconomic characteristics, health behavior and residence. Socioeconomic characteristics consists of age, gender, level of education and income, marital status and occupation. Age was categorized into 20-30s, 31-40s, 41-50s, 51-61s, 61-70, and over 70 years old, which the youngest age group is reference. Gender was categorized into man and woman. Level of education was categorized into under graduation of elementary school, middle school, high school and over the graduation of college. The job was categorized into white color occupation, blue color occupation and inoccupation. The income was categorized into low income, middle income and high income by using quartile of monthly household equalization income. Marital status consists of married and single.

Health behavior was composed by subjective health status, smoking, drinking, physical activities and eating habits. The smoking was categorized by non-smoker, former smokers and current smokers. The frequency of drinking alcohol was categorized by never, rare, often and usually drinking alcohol. Physical activity includes walking, moderate and vigorous activity. They are categorized by using day on activity during a week and duration of activity. Subjective heath status was recategorized into three level such as norm, good and bad status. If person response very good or good to the question to ask usual health, they are categorized into good status. If, on the contrary to this, people response very bad or bad, they are categorized into bad status. The others were categorized into norm. Eating habits include amount of daily total kcal, fat intake, water intake and salt intake.

Residence were classified by using cluster analysis with factor score. Thus, regions are categorized into fishing regions, service industry regions, aging in rural regions, rural-urban integration regions and CBD which is reference within the logistic model.

3.3 Analytical Methods

The purpose of this paper is to examine the cluster analysis with factor score driven from the factor analysis before analyzing health disparity. Since the 1990s, there have been more cases of attempting to classify the types of policies to apply to rural areas that are different from urban areas, such as backward regions and medical access disadvantaged areas (Kim et al., 2014). As regions has various characteristics, regional classification is need to develop and implement appropriate local policy by understanding and considering factors (Lee , 2002; Song & Knaap, 2007).

For this reason, it is needed to compact them as a few variables while they are simultaneously considered. In order to solve this problem, factor analysis is used to reduce the multicollinearity and to generate the concept to include multiple attribute (Song & Knaap, 2007; Lee, 2002) “Because so many land-use measures are now readily available, it is potentially useful to reduce the multiple and often highly intercorrelated measures into a few regional characteristics using cluster analysis based on factor analysis. ” (Song & Knaap, 2003; Lee & Lee, 2011).

In addition, Song & Knaap (2007) classified neighborhood of new single-family house using quantitative methods which are factor analysis and cluster analysis. They proposed that reasons of classification of neighborhood types;1)classification helps people to understand characteristics urban neighborhood. In the case of city and county as the analysis unit, the area with strong descendant or urban attributes and the region with strong rural attributes are combined to one unit, which may lead to the problem of distorting the interpretation of the classification result. (Lee., 1995; Kim et al., 2014).

We first summarized descriptive statistics of variables for regional classification and conducted factor analysis to reduce the small set of region characteristics. Next, cluster analysis was used to assign the region type and 3474 eup,myeon,dong as unit. Cluster analysis is method to classify each factor into a cluster by the Statistical manipulation by compacting some characteristics of factors to be classified in the absence of external criteria of classification (Lee, 2002). This is appropriate method for this study in terms of classifying relatively similar regions into common type by estimating the similarity between regions and selecting the factor to explain characteristics of regions.

Second, we compared overall disparity between regional classification about prevalence of chronic disease, obesity and depression between regions by using chi-square test. Next, multiple logistic regression was used to explored odd ratio(OR) of health status with control variables including demographic and socioeconomic characteristics by using STATA 13. They were based on complex survey sample analysis to apply stratified weight value offered by Korea Center of Disease Control and Prevention.

IV. Results

4.1 Regional classification using cluster analysis

a. Structure characteristics of regions using factor analysis

Using 18 variables measuring represent characteristics of regions, we conducted the factor analysis to compact the dimension of variables to four factors which eliminate redundancy and correlation in variables. The factors which were over one of eigenvalue were extracted with varimax rotation based on principal component analysis. Table 2 showed the factor loading which explained that correlation between each factor and 18 variables. The factor was defined using the characteristics of variables which have over 0.5 factor loading value.

Table 2. Results of factor analysis

Variable	Urban with high density	Full time older farmers	Service area	Fish
	Factor1	Factor2	Factor3	Factor4
Population density	***0.712***	-0.390	0.172	-0.200
Urbanization area ratio	***0.866***	-0.358	0.175	-0.120
Building density	***0.878***	-0.268	0.182	-0.113
Road density	***0.848***	-0.195	0.220	-0.085
Office building density	***0.544***	-0.005	0.132	-0.028
Commercial building density	***0.556***	0.167	0.273	0.026
Apartment density	***0.527***	-0.438	0.137	-0.176
Forest area ratio	***-0.850***	0.258	0.175	-0.144
Full time farming household	-0.461	***0.684***	-0.142	-0.060
Farming household	-0.458	***0.790***	-0.113	0.035
Aging index	-0.297	***0.803***	0.048	-0.004
Farmer with a side job	0.185	***-0.796***	0.102	0.009
Manufacturing employment	-0.139	0.195	***-0.784***	-0.020
Service employment	0.195	0.056	***0.793***	0.199
Agriculture area ratio	-0.217	0.373	***-0.554***	0.316
Full time fishing household	-0.074	-0.138	0.076	***0.700***
Fishing household	-0.128	0.062	0.150	***0.705***
Fisher with a side job	-0.057	0.046	-0.020	***0.802***

The factor 1 was related to the mountainous district(-0.85), office building density(0.544), commercial building density(0.556), apartment density(0.527), population density(0.712), road density(0.848), building density(0.878) and urbanization area(0.866). Thus, this factor represented characteristics of urban with high density. The factor 2 was related to farming variables such as farmer with a side job(-

0.796), Full time farming household(0.684), farming household(0.790). In addition to them, this factor was closely related to the aging index(0.803). Thus, factor 2 defined elderly farm village where full time farming household live. Factor 3 was positively related to the service employment (0.793) and negatively manufacturing employment(-0.784) and agriculture area ratio(-0.554). Thus, this factor was defined service industry area. Factor 4 included the characteristics of fish village such as full time fishing household(0.7), fisher with a side job(0.802), and fishing household(0.702). This factor represented typical fishing village.

b. Cluster analysis

Based on factor score derived from factor analysis, K-means clustering was used to classify 3,247 eup·myeon·dong into 5 types on similarity and dissimilarity between six factor score. The number of clusters was based on the interpretability of the results which was dendrograms derived from Ward's linkage. Table 3 presented the cluster centroid values which represent typical characteristics of each region type. These values showed that how centroid values distributed between classification types (figure 1). The clusters were defined based on information explained by centroid values.

Table 3. Comparing regions in four factors based on centroid value of cluster

factors	Fishing region	Service Industry region	Aged rural region	Rural-urban integration region	CBD
Urban with high density	-0.348	-0.465	-0.794	-0.096	1.431
Full time older farmers	-0.091	-0.828	1.220	0.343	-0.121
Service	0.298	0.234	0.459	-1.691	0.375
Fish	2.165	-0.384	-0.590	-0.002	-0.268

Cluster 1 had positive centroid value on the fish area factor(2.165) and service factor(0.298), but it had negative centroid values on urban factor and full time older farmers (-0.384 and -0.091). Thus cluster 1 was defined as Fishing region. In case of cluster 2, only service factor had positive centroid value within cluster 2. Based on this information, this type was defined as service industry region. Although cluster 3 had positive centroid value on full-time older farmer and service, this was named as aged rural region due to higher value of factor 2 than factor3. In addition, the centroid value of urban factor was negative as -0.794. Thus, this cluster had more rural characteristics than urban. Cluster 4 had positive value on full-time older farmers and negative value on the others. Among them, the value of

factor 1 was lower than in aged rural region clusters. Thus, this cluster was defined rural-urban integration region. Finally, the cluster 5 was named as CBD because high positive centroid value on urban with high density and service factors.

Figure 2 showed the spatial distribution of the regions divided by the cluster analysis and the regions divided into administrative districts. In detail, figure 2.a presented dong assigned as urban (pink color) and eup·myeon assigned as rural(yellow green color), which is based on administrative districts. Figure 2b showed the spatial distribution of fishing regions (blue color), service industry regions (orange color), aged rural regions (yellow color), rural-urban integration (green color) and CBD by cluster analysis. According to clustering maps, the classification of administrative districts is classified as rural except for the metropolitan area and surrounding areas. However, in the case of regional classification using cluster analysis, the regions classified as rural used in the previous studies were subdivided into fishing regions, aged rural regions, rural-urban integration regions and parts of the service industry regions. In addition, regions classified as general cities are divided into CBD and other parts of service industry regions. Despite being able to categorize in more detail, simply dividing the area into administrative districts can also lead to underestimating health status in analyzing health disparity. This study analyzed regional health disparities by using regional classification and understood characteristic of Korea different from US.

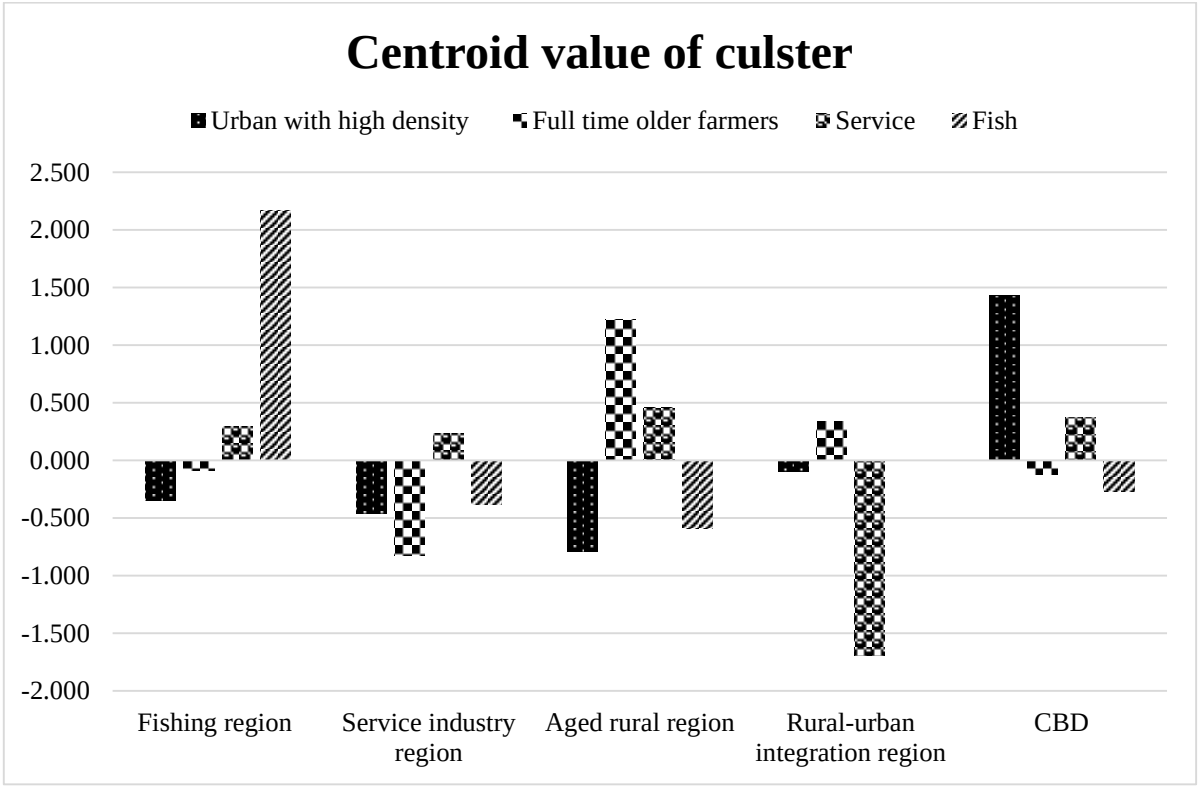
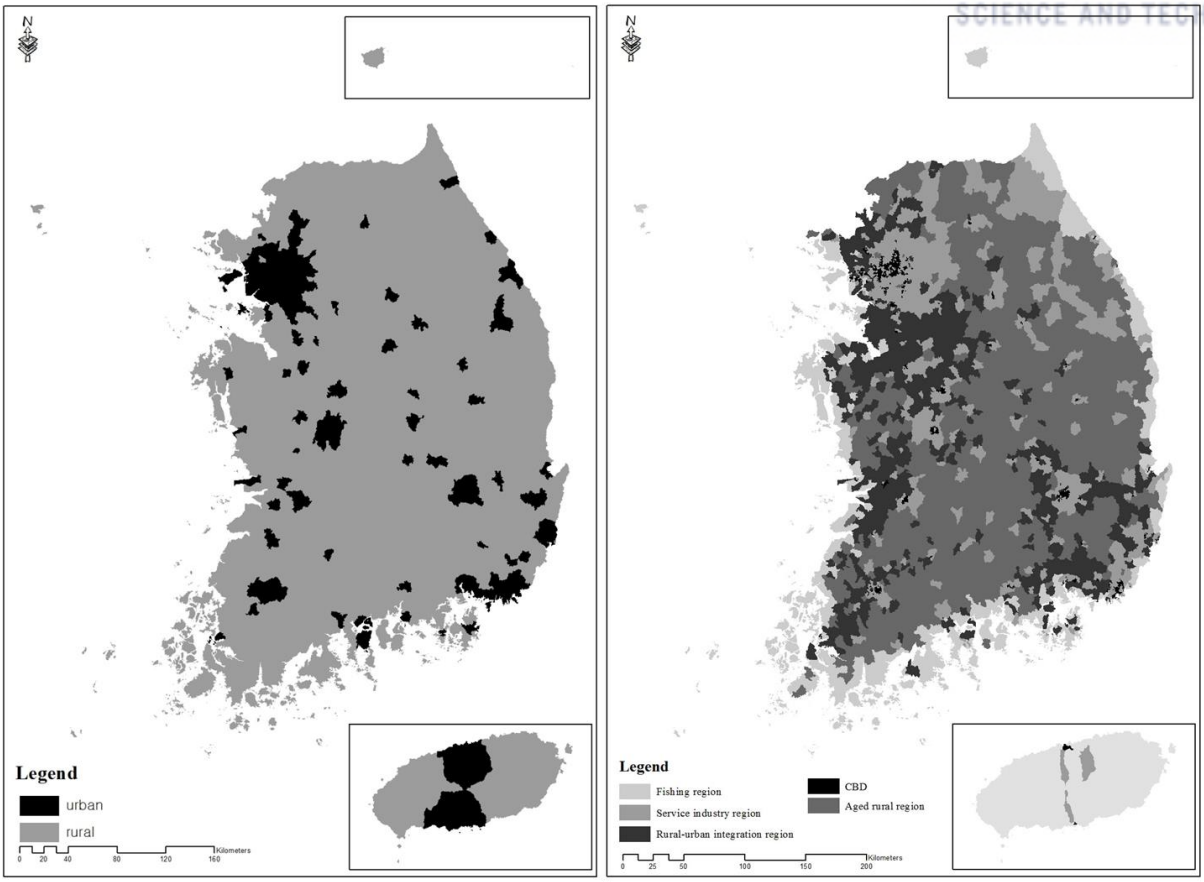


Figure 1. Centroid values of clusters



(a) Urban and rural classification using administrative units (b) Regional classification using cluster analysis

Figure 2. Map on regional classification

4.2 Health disparity by regions

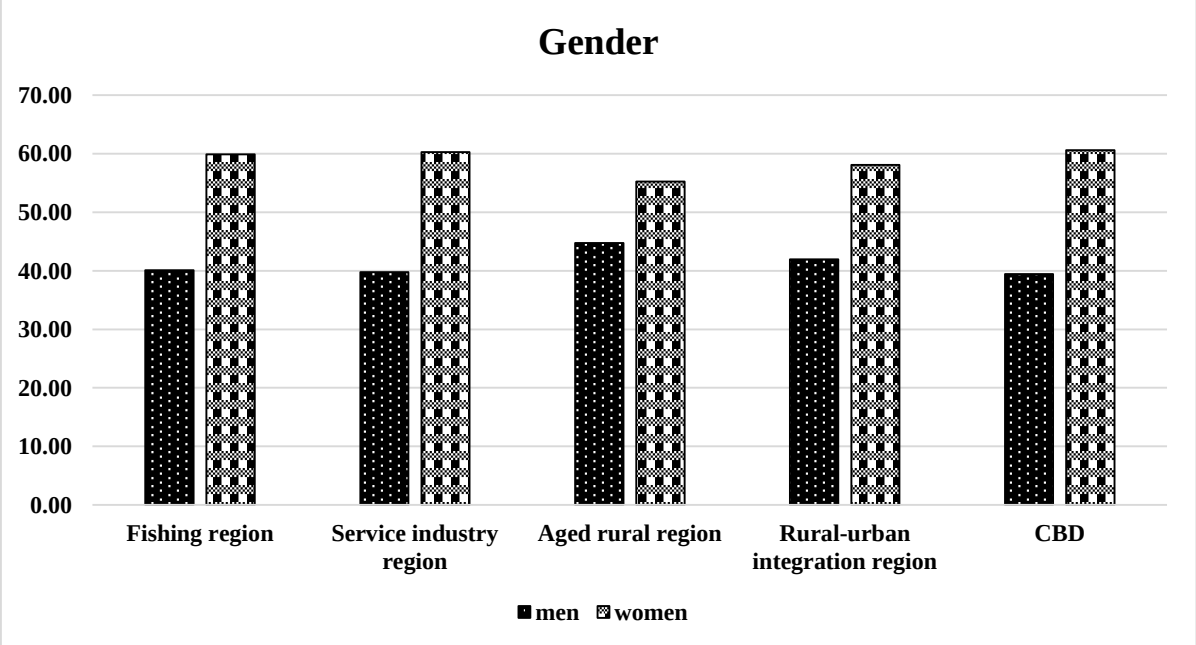
a. Characteristics of participant by regional classification

Before analyzing disparity in health status by regions, figure 3,5 and table 4 presented the distribution of socioeconomic characteristics, health behavior and overall health status Korean adults. In the weighted sample, 11.92%, 39.15%, 6.20%, 14.44%and 28.28% of participants lived in fishing region, service industry region, aged rural region, rural-urban integration region and central business district(CBD). First, distribution of socioeconomic characteristics among regions were analyzed by gender, age, income level, occupation, educational level, and type of marriage (figure3). In all regions, the percentage of women participants was higher than that of men. In detail, man group has the highest ratio in aged rural region at 44.74%, followed rural-urban integration region, fishing region, service industry region and CBD. Unlike man group, the percentage of woman participants is highest in CBD at 60.58%. In the case of education level and income level, the ratio of less than primary school graduation and low income class were highest in aged rural region at 62.22% and 49.24%, whereas the ratio of over the university graduation is highest in CBD at 33.35% and ratio of high income class is

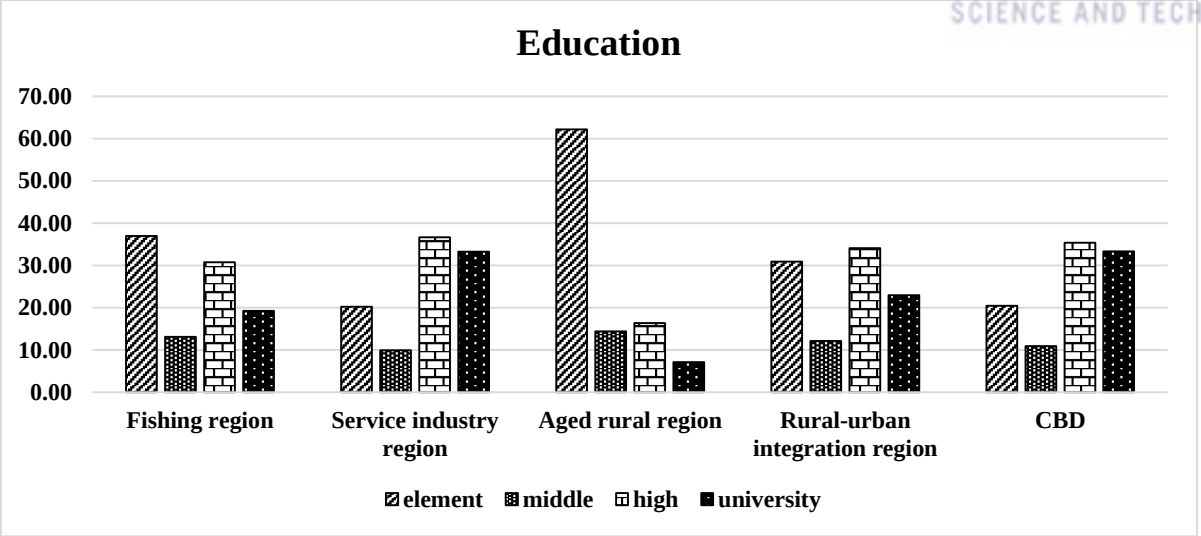
highest in service industry region at 29.89%. In the case of occupation, the 63.59% of blue collar is highest ratio within blue collar group and in aged rural region among regions. In case of white collar, percentage of CBD is higher than other regions. Residences in aged rural region were more likely to be married than other regions at 95.83%, whereas participants in CBD were more likely to be single than the others.

Table 4 showed the distribution of health behaviors including smoking, drinking alcohol, vigorous activity, moderate activity, walking activity and self-rated health and figure 3 is results of unadjusted analyses on prevalence of chronic diseases, obesity and depression. The distribution was presented by sex because these distribution were different by sex(Jeon et al.,2016; Kim and Jeong, 2009; Yoon and Kim, 2006; Kim 2005). According to Table 4, health behaviors were statistically significant different by regions except to vigorous activity of woman($p<0.05$). First, self-rated health, the ratio of the subjects who are perceived to be unhealthy is lower in aged rural region than in other region. Especially, the difference among regions in women who perceived poor health is the largest.

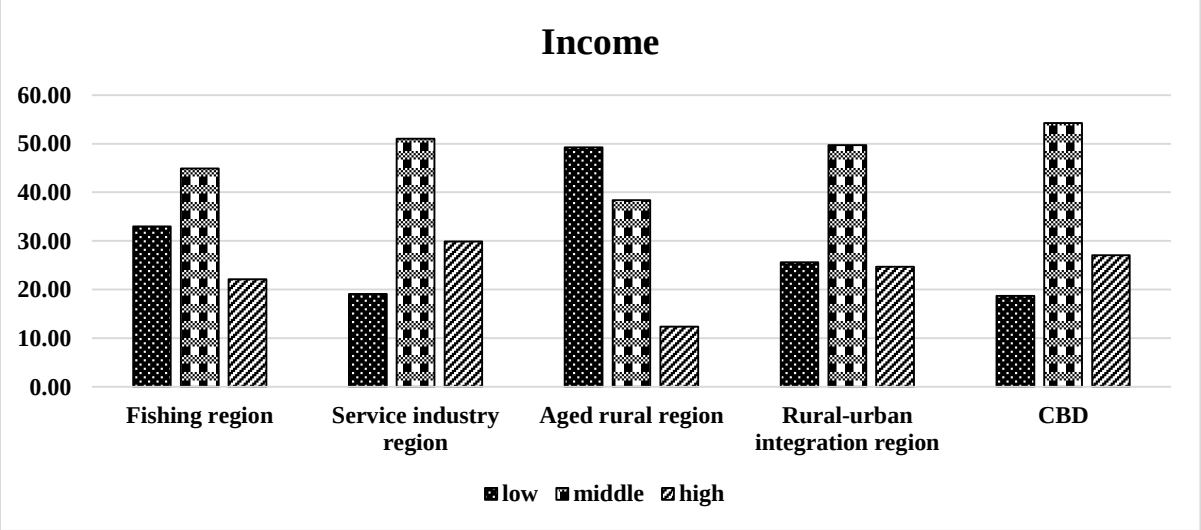
In case of smoking, overall, the smoking rate of males was higher than that of females regardless of region. In detail, current smoking rate of aged rural region of male is highest at 57.25% and past smoking rate of CBD of male is highest at 30.12%. Compared to other regions, the non-smoking rate is highest at fishing village. Unlike results of men, the current smoking rate and past smoking rate of CBD is highest at 7.32% and 4.15% among regions and aged rural region participants were more likely to be non-smoking rate(92.72%).



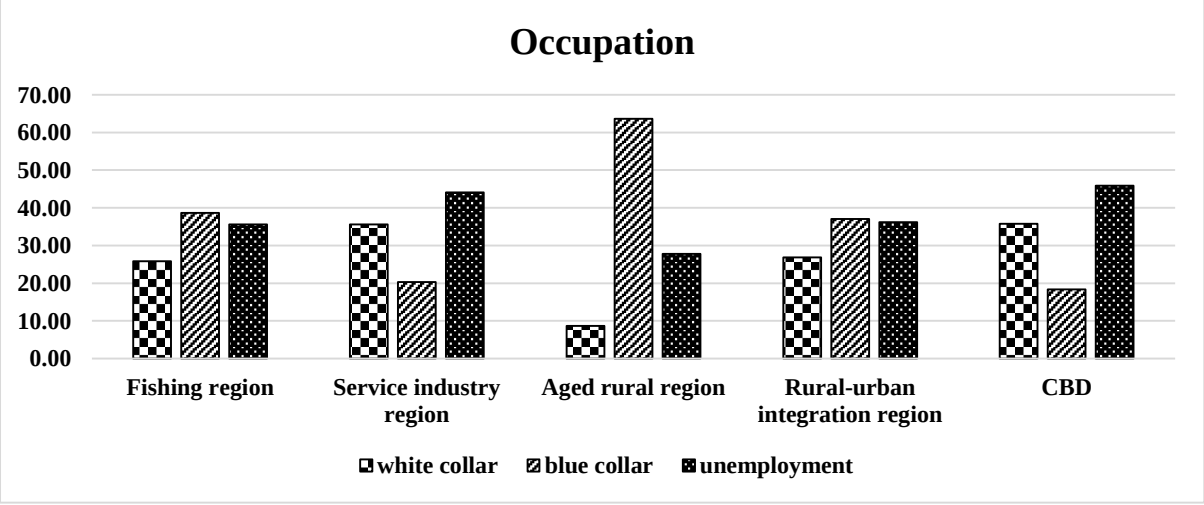
(a) Gender distribution among regions



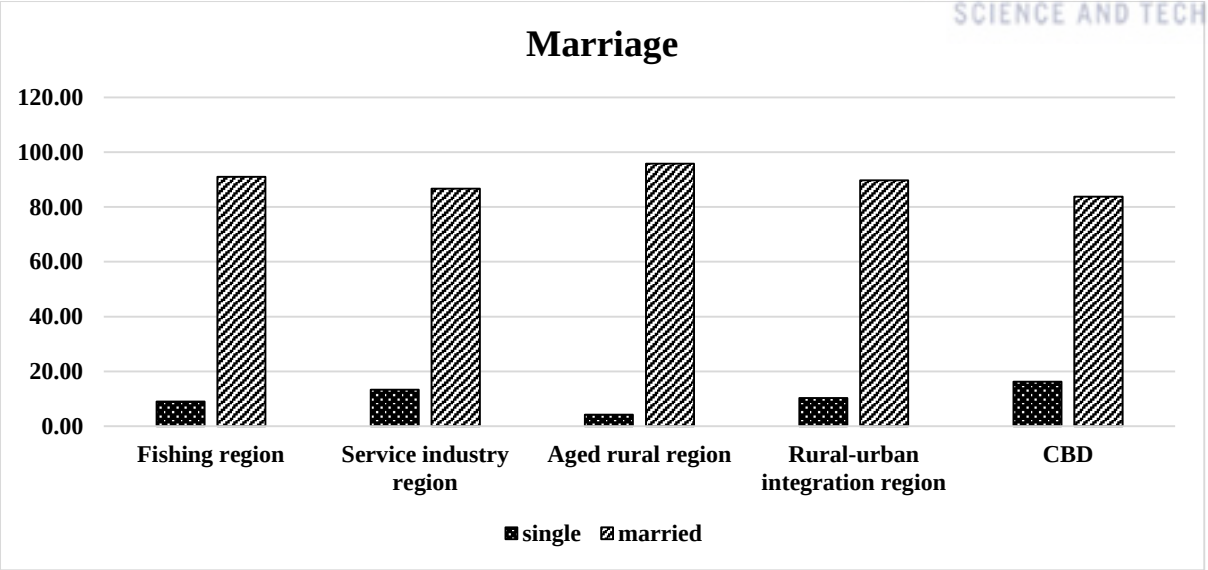
(b) Education distribution among regions



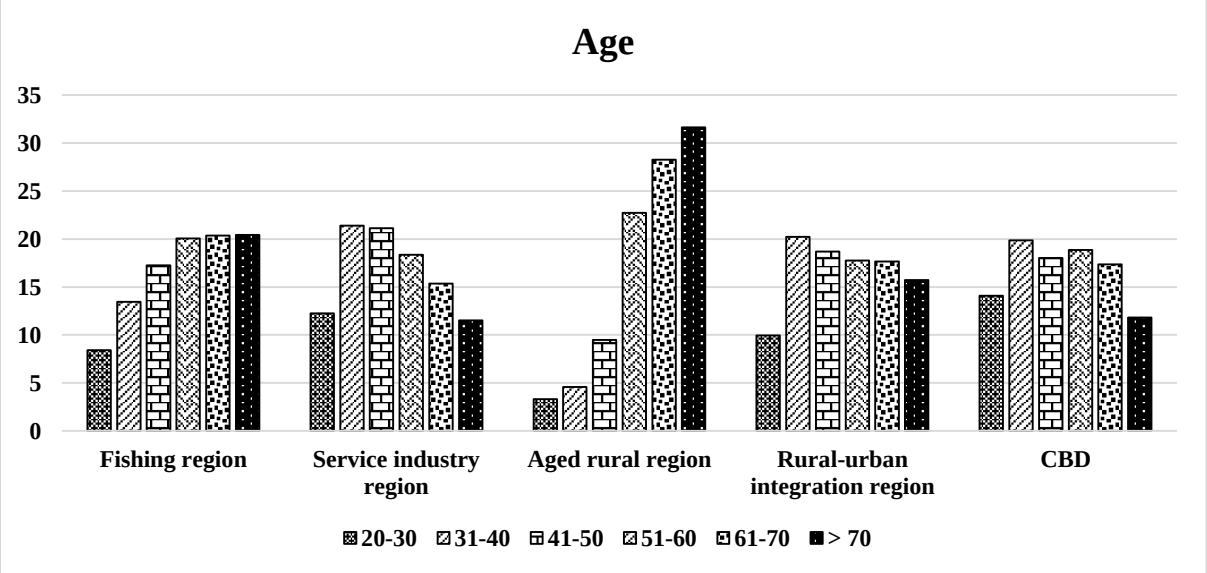
(c) Income distribution among regions



(d) Occupation distribution among regions



(e) Marriage distribution among regions



(f) Age distribution among regions

Figure 3. Distribution of socio-economic characteristics among regions

In case of drinking, overall drinking rate of man is higher than woman at all regions. The rare and never rate of man is highest at aged rural region(28.25% and 8.04%) and rate of man is lowest at CBD(4.37%). The rare of woman is highest at service industry region at 43.50% and the never rate of women is highest at aged rural regions. Compared to service industry region and CBD residence, the rate of non-drinking alcohol women in fishing village, aged rural region and rural-urban integration region is higher.

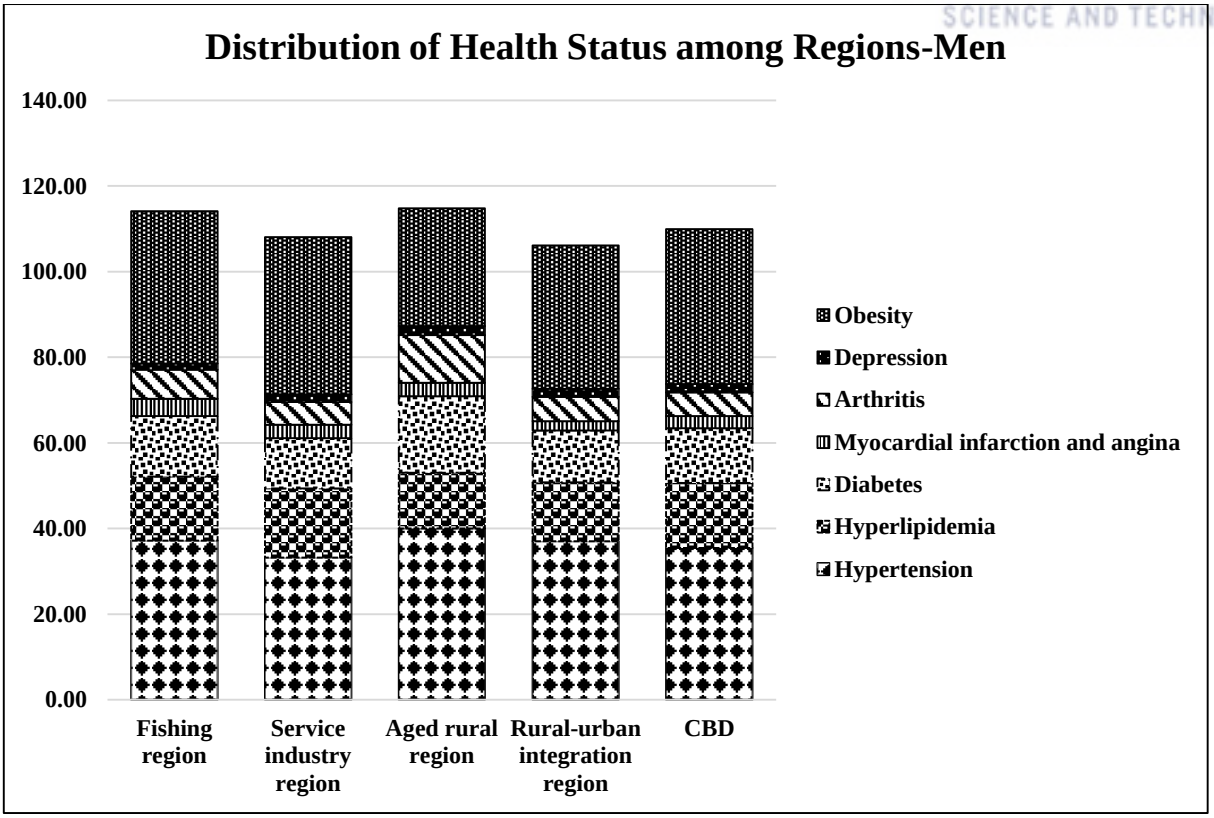
Table 4. Distribution health behavior among regions

Health Behaviors			Fishing region	Service Industry region	Aged rural region	Rural-urban integration region	CBD	p-value
Self-rated health	man	normal	41.71	45.74	40.00	41.71	44.69	<0.001
		good	36.12	*39.52*	34.18	39.09	40.58	
		bad	22.17	14.74	25.82	19.20	14.73	
	woman	normal	38.65	46.76	37.02	41.21	46.61	<0.001
		good	30.63	32.52	23.14	32.81	32.81	
		bad	30.72	20.72	39.85	25.98	20.57	
Smoking	man	current	55.47	52.82	57.25	54.41	49.64	<0.001
		past	24.14	27.87	26.67	25.27	30.12	
		never	20.39	19.31	16.08	20.32	20.24	
	woman	current	6.66	6.59	5.57	7.81	7.32	<0.001
		past	1.77	3.67	1.71	2.94	4.15	
		never	91.57	89.74	92.72	89.25	88.53	
Drinking	man	rare	22.48	21.44	28.25	22.21	22.03	<0.001
		often	31.51	37.14	20.00	32.40	38.55	
		usually	39.07	36.82	43.70	37.88	35.05	
		never	6.94	4.60	8.04	7.52	4.37	
	woman	rare	39.56	43.50	41.90	41.46	42.48	<0.001
		often	23.89	31.24	18.68	28.75	30.77	
		usually	8.84	8.48	6.43	8.68	9.58	
		never	27.71	16.78	32.99	21.11	17.16	
vigorous activity	man	yes	15.79	18.38	14.60	16.68	17.52	0.015
		no	84.21	81.62	85.40	83.32	82.48	
	woman	yes	12.66	12.00	10.11	11.03	11.55	0.13
		no	87.34	88.00	89.89	88.97	88.45	
moderate activity	man	yes	13.33	10.38	17.25	11.69	10.83	<0.001
		no	86.67	89.62	82.75	88.31	89.17	
	woman	yes	13.24	9.18	15.60	10.64	8.71	<0.001
		no	86.76	90.82	84.40	89.36	91.29	
walking activity	man	yes	43.49	41.23	43.07	38.55	42.90	0.007
		no	56.51	58.77	56.93	61.45	57.10	
	woman	yes	34.50	35.74	37.70	34.10	40.01	<0.001
		no	65.50	64.26	62.30	65.90	59.99	
Stress	man	yes	20.82	22.91	16.83	22.65	21.61	0.001
		no	79.18	77.09	83.17	77.35	78.39	
	woman	yes	29.28	26.79	28.02	28.43	28.54	0.066
		no	70.72	73.21	71.98	71.57	71.46	
Suicidal thoughts	man	yes	10.63	7.76	12.06	8.92	8.35	<0.001
		no	89.37	92.24	87.94	91.08	91.65	
	woman	yes	19.53	13.88	22.45	15.72	14.90	<0.001
		no	80.47	86.12	77.55	84.28	85.10	

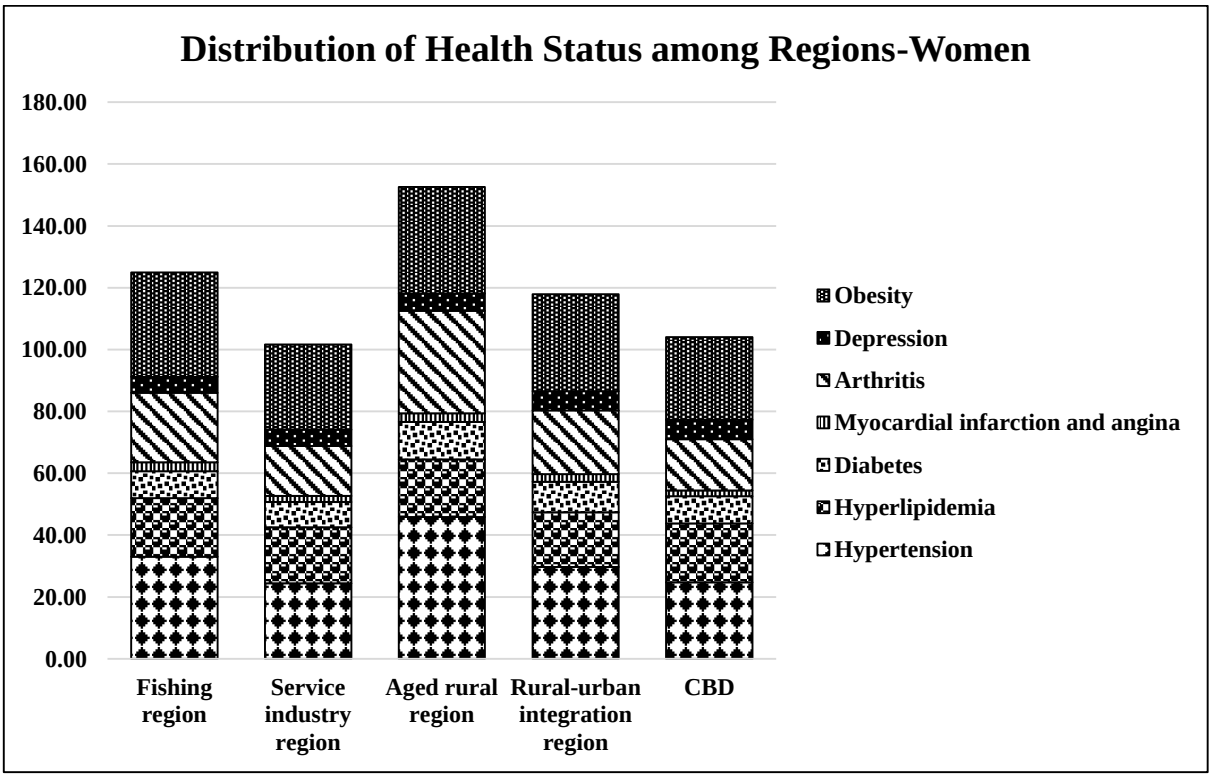
Physical activity consists of vigorous, moderate and walking activity. Overall pattern is percentage of man is higher than women. In detail, the percentage of man vigorous activity of service industry region is highest at 18.38 %, followed by CBD(17.52%), rural-urban integration regions(16.68%), Moderate physical activity was statistically significantly higher in aged rural region at 17.25%, followed by 13.33% in fishing village, 11.69% in rural-urban integration regions, 10.83% in CBD and 10.38% in service industry regions in case of men. The women showed overall similar results with men, but CBD is region where the percentage of activity is lowest. In case of walking physical activity, men and women showed different patterns. In case of men, the walking physical activity was statistically significantly higher in fishing regions at 43.49% than other regions, whereas this activity was higher in CBD at 40.04% in case of women.

The variables related to mental health behavior are stress and suicidal thoughts. Both have statistically significant differences depending on the residence area. In the case of stress, the men in the service region had the highest perceived stress(22.91%), while the women did not show statistically significant differences among regions.

According to results of comparison of regional health status(figure 4), There was a statistically significant difference in the prevalence rate according to the residence area except hyperlipidemia of women($p<0.05$). In case of hypertension, man in aged rural region showed highest prevalence at 40%, followed by rural-urban integration region(37%), fishing regions(37.16%), CBD(35.49%) and service industry region(33.25%). Women in aged rural region also presented highest prevalence at 45.84%, followed. In case of hyperlipidemia, man in service industry region presented highest value at 16.10. In case of diabetes, man showed highest value at aged rural regions(17.88%)and lowest value at service industry(11.79%) among regions. Women also showed similar order results(tabel5). In case of myocardial infarction and angina, both men and women in fishing regions presented highest prevalence at 3.99% and 2.88%. In case of arthritis, women showed higher prevalence than men. Both men and women in aged rural region showed highest prevalence at 11.1% and 33.08%.



(a) Distribution of health status among regions of men



(b) Distribution of health status among regions of men

Figure 4. Distribution of disease by regions by gender

b. Health disparity by regions

Multiple logistic regression analysis was conducted to determine whether there were regional disparities in health status based on CBD with socio-demographic characteristics such as gender, age, and income level controlled.

Chronic Diseases

The results on chronic disease are presented by table 5. First, compared to youngest group (20-30), the older age groups were more likely to prevalence rate of chronic diseases. The prevalence of hypertension, diabetes and arthritis decreased as education level increased. This result wasn't shown to the other diseases. Compared to inoccupation who are student, housewife and unemployed person, employed groups were less likely to prevalence rate of hypertension, hyperlipidemia and diabetes

In case of income, compared to high income class, the others were likely to prevalent more than 11% of hypertension and diabetes. In case of health behaviors, the prevalence of chronic diseases increased as amount of kcal increased but, variables related to the diet habit weren't statistically significant. There were no results that physical activity groups were less likely to prevalence of chronic diseases, compared to the non-physical activity groups. Self-rated health level, smoking and drinking seem to affect the chronic diseases rather than diet or physical activity groups. As expected, participants who recognized their health is good were less likely to the prevalence of chronic disease compared to normal participants, but in case of bad the results were opposite. After controlling for socio-demographic factors and health behaviors, health disparities in prevalence of chronic diseases were different between results of unadjusted and adjusted analysis(table 5 & table 7). The prevalence of chronic diseases in aged rural regions was less than CBD unlikely result on distribution. In case of hyperlipidemia, participants in fishing region and rural-urban integration region as well as aged rural region were 0.88 ,0.66 and 0.9 times less likely to prevalent diseases. In case of diabetes, fishing region residents has lower have 0.823times lower chance of getting diabetes. The result by regions is similar with diabetes case

Obesity

The results on obesity are shown by table 6. First, compared to youngest group (20-30), the older age groups were more likely to prevalence rate of obesity. Effect wasn't same as the prevalence of chronic diseases. The prevalence of obesity also decreased as education level increased. Compared to inoccupation who are student, housewife and unemployed person, prevalence of obesity is higher to white collar but, it is lower to blue collar. In case of income, compared to high income class, the others were likely to prevalent more than 10% of obesity. In case of health behaviors, variables related to the diet habit were statistically significant, but the effect was slight. Vigorous physical activity participant was more likely to prevalence of chronic diseases, compared to the non-physical activity participants.

Self-rated health level, smoking and drinking seem to affect the chronic diseases rather than diet or physical activity participants. As expected, participants who recognized their health is good were less likely to the prevalence of chronic disease compared to normal participants, but in case of bad the results were opposite. According to table 7, participants in fishing region were 9 times more likely to prevalent obesity, but in the aged rural regions, people were 0.85 times less likely to do. This result also was different from result on distribution of health disparity by regions.

Depression

As expected, the prevalence of depression increase as age increased and education level is over the university graduate school (table 6) . Compared to participants who are inoccupation, the white collar and blue collar participants were 0.59 and 0.75 times less likely to experience depression. As with other diseases, the larger the eq-5d index and the better the self-rated, the less likely it is to experience depression than the people who do not. The prevalence of depression was greater among current and past smoking participants than non-smokers. People who have had stress or suicidal thoughts are 1.76 times and 2.34 times more likely to have depression than mental health people. The result of adjusted analysis on regional health disparity is similar with expected results that the prevalence of depression in other regions is lower than CBD(\ table 7). However, this result is different from the distribution.

a. Health disparity by regions within income level.

Jung and Cho(2005) insisted that people with high socioeconomic status and those who do not lived together in one administrative unit unlike the US where there are not so many differences between local residents at the socioeconomic level. Therefore, this performed an addition analysis to examine whether the difference in health level between the regions would have performed within a specific income. The results are shown in table 8 and table 9.

Disparity in prevalence of hypertension and cardiac disease by regions wasn't showed specific income class, whereas prevalence of hyperlipidemia, diabetes, arthritis, obesity and depression presented regional health disparity within income class. In detail, he prevalence of hyperlipidemia in fishing region and aged rural region was 0.78 and 0.6 times less than CBD. However, this trend wasn't showed among high income participants. In case of diabetes, the result was similar with hyperlipidemia within low and high income class (Fishing region, OR 0.73, 95% CI 0.6-0.9; Aged rural region, OR 0.66, 95% CI 0.53-0.83). In case of arthritis, prevalence in fishing region was 0.8 times less than CBD. In case of obesity, regional health disparity was presented within both low and high income level. Within low income level(table8), compared to CBD participants, aged rural region participants were less obese.

Table 5. Logistic regression on chronic disease (continued)

Variables		Hypertension			Hyperlipidemia			Diabetes			Cardiac Disease			Arthritis		
		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
gender	man	**1.578**	1.45	1.73	**0.722**	0.66	0.80	**1.695**	1.50	1.93	**1.481**	1.17	1.89	**0.278**	0.25	0.32
age	31-40	**2.370**	1.92	2.93	**2.557**	2.01	3.26	**2.157**	1.45	3.22	1.786	0.36	9.02	**1.926**	1.23	3.04
	41-50	**6.219**	5.03	7.70	**4.974**	3.90	6.36	**6.063**	4.12	8.94	**7.088**	1.53	32.88	**4.101**	2.63	6.40
	51-60	**12.722**	10.26	15.79	**12.512**	9.79	16.00	**11.778**	7.99	17.37	**23.501**	5.15	107.32	**11.805**	7.61	18.33
	61-70	**24.272**	19.48	30.25	**15.324**	11.93	19.70	**18.573**	12.56	27.48	**54.522**	11.94	249.16	**22.703**	14.58	35.37
	> 70	**33.606**	26.78	42.18	**9.870**	7.61	12.81	**16.729**	11.23	24.93	**68.033**	14.81	312.73	**25.032**	15.98	39.22
education	Middle school	**0.804**	0.74	0.88	1.062	0.97	1.18	0.952	0.85	1.07	**1.299**	1.06	1.60	0.946	0.85	1.06
	High school	**0.764**	0.71	0.83	1.077	0.99	1.19	0.924	0.83	1.04	1.123	0.91	1.40	**0.663**	0.60	0.75
	> University	**0.633**	0.58	0.71	1.033	0.93	1.16	**0.741**	0.65	0.86	1.126	0.85	1.50	**0.569**	0.49	0.67
occupation	White collar	0.979	0.91	1.06	**0.905**	0.84	0.99	**0.797**	0.72	0.90	0.986	0.79	1.25	0.911	0.82	1.03
	Blue collar	**0.835**	0.78	0.90	**0.812**	0.76	0.88	**0.716**	0.66	0.79	0.851	0.72	1.03	1.092	1.00	1.20
income	Low income	**1.155**	1.06	1.27	0.964	0.88	1.07	**1.143**	1.02	1.30	0.974	0.77	1.24	0.903	hyper	1.02
	Middle income	**1.110**	1.04	1.20	0.985	0.92	1.07	**1.135**	1.03	1.27	1.099	0.89	1.37	0.913	0.83	1.02
marry	Married	**0.800**	0.69	0.94	0.920	0.77	1.11	1.019	0.79	1.33	1.927	0.80	4.69	1.285	0.92	1.80

** bold number : $p<0.05$

Table 5. Logistic regression on chronic disease (continued)

Variables		Hypertension			Hyperlipidemia			Diabetes			Cardiac Disease			Arthritis		
		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
eating habit	amount of daily total kcal	**1.001**	1.01	1.01	1.000	1.00	1.01	1.000	1.00	1.01	**0.999**	1.00	1.00	**0.999**	1.00	1.00
	fat intake	**0.997**	1.00	1.00	**1.002**	1.01	1.01	1.001	1.00	1.01	1.005	1.00	1.02	**1.003**	1.01	1.01
	fat water	**1.003**	1.01	1.01	1.000	1.00	1.01	1.001	1.00	1.01	0.998	1.00	1.01	**0.998**	1.00	1.00
	fat salt	**1.000**	1.01	1.01	1.000	1.00	1.01	1.000	1.00	1.01	1.000	1.00	1.01	1.000	1.00	1.01
physical activity	Vigorous	1.001	0.93	1.09	0.978	0.90	1.08	0.997	0.89	1.12	0.951	0.76	1.21	1.059	0.95	1.19
	Moderate	0.973	0.89	1.07	0.917	0.83	1.02	1.033	0.92	1.18	1.008	0.79	1.30	1.040	0.93	1.18
	Walking	1.014	0.96	1.08	1.009	0.95	1.08	**1.088**	1.01	1.18	0.949	0.82	1.11	1.011	0.94	1.10
EQ5D-index		0.874	0.70	1.11	**0.685**	0.54	0.88	1.047	0.80	1.39	0.641	0.41	1.01	**0.060**	0.05	0.08
self-reported health	good	**0.803**	0.76	0.86	**0.835**	0.78	0.90	**0.626**	0.57	0.70	**0.636**	0.52	0.80	**0.730**	0.67	0.81
	bad	**1.301**	1.22	1.40	**1.344**	1.25	1.46	**1.823**	1.67	2.00	**2.422**	2.04	2.88	**1.319**	1.21	1.45
smoking	Current smoking	**0.867**	0.80	0.95	**1.141**	1.03	1.27	**1.234**	1.10	1.40	1.178	0.93	1.51	**0.866**	0.76	1.00
	Past smoking	0.983	0.89	1.09	1.116	1.00	1.26	**1.167**	1.02	1.34	**1.383**	1.08	1.79	0.986	0.85	1.16
drinking alcohol	Rare	**0.818**	0.76	0.89	0.925	0.85	1.01	**0.898**	0.81	1.00	0.914	0.76	1.11	1.018	0.93	1.12
	Often	**0.912**	0.84	1.00	**0.884**	0.81	0.98	**0.806**	0.72	0.92	0.964	0.77	1.21	1.048	0.94	1.18
	Usually	**1.173**	1.07	1.30	0.945	0.85	1.06	**0.793**	0.70	0.91	0.818	0.64	1.07	1.098	0.96	1.27
regions	Fishing region	0.919	0.84	1.01	**0.883**	0.80	0.98	**0.823**	0.73	0.94	1.112	0.89	1.41	**0.827**	0.74	0.94
	Service industry region	0.999	0.94	1.07	1.022	0.96	1.10	0.950	0.87	1.05	1.137	0.96	1.37	1.001	0.92	1.10
	Aged rural region	**0.824**	0.74	0.93	**0.666**	0.59	0.77	**0.859**	0.74	1.00	**0.718**	0.54	0.98	**0.856**	0.75	0.99
	Rural-urban integration region	1.057	0.97	1.16	**0.900**	0.82	1.00	0.951	0.85	1.08	0.925	0.73	1.18	0.957	0.85	1.08

Table 6. Logistic regression on obesity and depression

Variables		Obesity			Depression		
		OR	95% CI		OR	95% CI	
gender	man	**1.494**	1.39	1.61	**0.341**	0.28	0.42
age	31-40	**1.183**	1.05	1.34	1.378	1.00	1.90
	41-50	**1.435**	1.27	1.63	**1.722**	1.24	2.40
	51-60	**1.495**	1.31	1.71	**2.199**	1.57	3.09
	61-70	**1.416**	1.24	1.63	**2.127**	1.50	3.04
	> 70	0.978	0.85	1.14	1.362	0.94	1.99
education	Middle school	**0.851**	0.79	0.93	1.136	0.95	1.37
	High school	**0.716**	0.67	0.78	1.013	0.85	1.22
	> University	**0.576**	0.53	0.64	**0.695**	0.56	0.88
occupation	White collar	**1.159**	1.09	1.24	**0.591**	0.51	0.70
	Blue collar	**0.915**	0.86	0.98	**0.746**	0.65	0.87
sincome	Low income	**1.097**	1.02	1.19	1.014	0.85	1.23
	Middle income	**1.135**	1.07	1.21	1.049	0.91	1.22
marry	Married	**1.241**	1.11	1.39	0.837	0.63	1.12
eating habit	amount of daily total kcal	**1.000**	1.01	1.01	1.000	1.00	1.01
	fat intake	1.000	1.00	1.01	1.003	1.00	1.01
	fat water	**1.001**	1.01	1.01	0.999	1.00	1.01
	fat salt	**1.000**	1.01	1.01	1.000	1.00	1.01
physical activity	Vigorous	**1.112**	1.04	1.20	**1.233**	1.05	1.46
	Moderate	1.025	0.95	1.11	0.948	0.79	1.15
	Walking	0.987	0.94	1.04	1.012	0.90	1.15
EQ5D-index		**0.455**	0.37	0.57	**0.300**	0.21	0.44
self-reported health	good	**0.940**	0.89	1.00	**0.614**	0.53	0.73
	bad	1.043	0.98	1.12	**1.449**	1.27	1.67
smoking	Current smoking	**0.927**	0.86	1.00	**1.287**	1.07	1.55
	Past smoking	0.988	0.91	1.08	**1.405**	1.13	1.76
drinking alcohol	Rare	**0.888**	0.83	0.96	**1.191**	1.02	1.40
	Often	**0.902**	0.84	0.98	0.996	0.83	1.20
	Usually	**0.864**	0.79	0.95	1.144	0.92	1.43
regions	Fishing region	**1.091**	1.01	1.19	**0.709**	0.59	0.87
	Service industry region	1.028	0.97	1.09	**0.868**	0.76	1.00
	Aged rural region	**0.845**	0.76	0.95	**0.704**	0.55	0.91
	Rural-urban integration region	1.020	0.95	1.11	0.940	0.79	1.13
mental health	stress				**1.761**	1.56	1.99
	Suicidal thoughts				**2.340**	2.04	2.69

** bold number : $p<0.05$

Table 7. Results of logistic regression about total samples

Diseases	Fishing region			Service industry region			aged rural region			rural-urban integration		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Hypertension	0.92	0.84	1.01	1.00	0.94	1.07	**0.82**	0.74	0.93	1.06	0.97	1.16
Hyperlipidemia	**0.88**	0.80	0.98	1.02	0.96	1.10	**0.67**	0.59	0.77	**0.90**	0.82	1.00
Diabetes	**0.82**	0.73	0.94	0.95	0.87	1.05	**0.86**	0.74	0.99	0.95	0.85	1.08
Cardiac Disease	1.11	0.89	1.41	1.14	0.96	1.37	**0.72**	0.54	0.98	0.92	0.73	1.18
Arthritis	**0.83**	0.74	0.94	1.00	0.92	1.10	**0.86**	0.75	0.99	0.96	0.85	1.08
Obesity	**1.09**	1.01	1.19	1.03	0.97	1.09	**0.85**	0.76	0.95	1.02	0.95	1.11
Depression	**0.71**	0.59	0.87	**0.87**	0.76	1.00	**0.70**	0.55	0.91	0.94	0.79	1.13

Table 8. Results of logistic regression about low income class

Diseases	Fishing region			Service industry region			Aged rural region			rural-urban integration region		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Hypertension	0.87	0.75	1.03	1.04	0.91	1.19	0.90	0.76	1.07	0.99	0.85	1.17
Hyperlipidemia	**0.78**	0.65	0.94	1.07	0.93	1.25	**0.60**	0.48	0.74	0.91	0.76	1.10
Diabetes	**0.73**	0.60	0.90	0.92	0.79	1.09	**0.66**	0.53	0.83	0.84	0.69	1.03
Cardiac Disease	1.06	0.74	1.53	1.29	0.95	1.75	0.89	0.60	1.36	1.04	0.72	1.51
Arthritis	**0.80**	0.66	0.97	1.07	0.92	1.26	0.84	0.69	1.04	0.97	0.81	1.18
Obesity	0.89	0.77	1.05	1.01	0.90	1.16	**0.71**	0.60	0.85	0.93	0.80	1.09
Depression	**0.60**	0.43	0.86	1.00	0.78	1.29	0.78	0.54	1.13	0.91	0.67	1.26

Table 9. Results of logistic regression about high income class

Diseases	Fishing region			Service industry region			Aged rural region			rural-urban integration region		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Hypertension	0.89	0.74	1.10	0.95	0.84	1.10	0.77	0.56	1.07	0.93	0.78	1.13
Hyperlipidemia	0.93	0.75	1.15	0.99	0.86	1.15	0.83	0.59	1.19	0.83	0.68	1.03
Diabetes	1.18	0.88	1.60	1.03	0.84	1.29	1.29	0.83	2.00	1.07	0.80	1.43
Cardiac Disease	1.39	0.76	2.59	1.34	0.87	2.10	0.73	0.24	2.23	1.04	0.55	2.00
Arthritis	0.95	0.71	1.29	0.99	0.81	1.22	1.07	0.70	1.63	0.95	0.72	1.27
Obesity	**1.24**	1.05	1.48	0.99	0.89	1.11	1.10	0.83	1.47	1.05	0.90	1.23
Depression	0.79	0.51	1.23	**0.70**	0.53	0.94	0.87	0.44	1.73	0.87	0.59	1.31

On the other hands, fishing regions participants were more obese than CBD within high income level. Health disparity in depression was also showed within both income levels. Compared to CBD, participants in aged rural region were less likely to experience depression within low income level and participants in service industry region were less likely to do within high income level.

V. Discussion

This study was conducted using KNHANES 2007-2014 data based on the hypothesis that the health condition among the regions is different. The main results were as follows. First, there is statistically significant different in regions. In detail, as a result of comparing the socio-demographic characteristics among regions, there was a statistically significant difference in the age, education level and income level between regions. Especially, the socio-demographic characteristics in aged rural regions are worst among regions. These results are similar with rural condition in previous literatures(Kim & Jeong, 2009; Jeon et al., 2013; Lee & Lee, 2012; Jeon, 2002; Lee et al., 2005; Lee, 2005; Jeon et al., 2016; Yoon and Kim, 2006; Ko, 2010; Hill et al., 2014; Davis et al., 2010; Bennett et al., 2011; O'Connor & Wellenius, 2012; Hartley, 2004; Weaver et al., 2013; Befort et al., 2012)

Second, the health disparity among regions derived from regional classification is more detail than classification using administrative units. Appendix 1 showed the result of health disparity among the regions. Compared to urban region, the prevalence of obesity in rural area(eup, myeon) wasn't significantly different. However, in case of regional classification, prevalence of obesity was statistically significantly different among regions. In addition, there was no difference in health level between the CBD and the regions that were classified as rural in the previous studies. In Korea, Lee (2005) suggested that regions are classified based on various characteristics and their health level are analyzed using new regional classification. If the regions are divided into administrative unit, it does not reflect the residential environment created by residents of various socio-economic class. Therefore, in analyzing the level of health among the regions, it is necessary not to use administrative units by referring to the US classification method but also to consider various points in order to show the characteristics of Korea.

Third, disease, obesity and depression was statistically significantly different among regions($p<0.05$) after adjusting for socio-economic characteristics and health behaviors, prevalence of chronic. Compared to CBD participants, aged rural regions, fishing region and rural-urban integration region were less likely to prevalent chronic disease and depression. These results are similar to the analysis of regional health level within the low income group. The results were inconsistent with previous literatures which presented health status in rural region was less than urban region(Jeon et al., 2016; Befort et al., 2010; Bennett et al., 2008; Bennett et al., 2011; Jackson et al., 2005; Eberhardt & Pamuk, 2004; Davis et al., 2011; O'Connor & Wellenius, 2012; Krishna et al., 2010; Patterson et al., 2004; Baernholdt et al., 2011; Jeon et al., 2013). The reason why the health level in aged rural region is lower than CBD is that the first one is due to the possibility that when the parents get the disease, they are

taken to the urban area where their children live, considering the sentiment of Korea. There is also the possibility that serious chronic illnesses have died and become low due to the physical and social isolation of the area or the deterioration of the accessibility of medical facilities(Jeon et al., 2013). Unlike the US, it is possible that the health behaviors in the rural areas are lower than those in the urban areas due to back to the farming of young people. Finally, it is possible that the causes of various micro dust emissions in urban have aggravated chronic diseases, resulting in poorer urban health. Shin (2007) argued that it is recognized as an important risk factor for cardiovascular and chronic diseases as well as respiratory diseases. He also showed that the concentration of micro dust in Seoul is considerably higher than that of developed countries including the US and Japan. In Korea, although it is said to improve the walking environment of the urban, many people are exposed to the environment where they ride cars and emit fine dust more than the United States. Therefore, unlike in the United States, it is possible that the health level of the city is lower than the rural health level.

In addition, the health disparity analysis was separately performed within the low-income and high-income groups by considering the hypothesis that the residence area may affect the health of the income groups. As a result, regional disparity in health status was presented in low income class. That is, health status of low income in aged rural regions, fishing regions, or rural-urban regions is better than CBD regardless of socio-demographic characteristics. This is in line with the results of Jeon et al. (2016) and Kim (2016), which show that urban low-income households have lower health status than rural low-income households, although the area is not the same. Overall, rural areas have obstacles and lack of infrastructure to receive medical services compared to urban(Hill et al., 2014; Davis et al., 2011; O'Connor and Wellenius, 2012; Krishna et al., 2010; Bennett et al., 2011). Compared to the absolute number and quality of infrastructures, rural areas are less than urban areas. However, market economy logic applies to the use of health services in urban areas. This means that the more money people pay, the better the service they get. This means that the spatial distribution of health care services is not properly distributed and is likely to be concentrated in a specific area where people can pay more. On the contrary, in the case of rural areas, various volunteer activities and medical support services are being provided to solve the medical level equity between urban and rural areas, which is intended to support rural residents regardless of income. Therefore, the prevalence of people in urban areas in low-income brackets seems to be lower than in rural areas.

The limitations of this study are, firstly, that it is difficult to explain the causal link between regional health status and cross-sectional study. In future research, structural relationships between individual characteristics, regional characteristics and health levels will be showed based on the conceptual framework. Second, the difference of health level among the regions, the most of previous literatures

are not able to consider the medical resources or services mentioned in the regional characteristics, but the health level of the regions. Future studies will include variables that reflect various regional characteristics, such as health care facilities, in addition to the characteristics of the regional classification used in this study. Third, although there are various indices that can measure health level, this study is about the health level of the region by chronic disease, obesity and depression only. Because the research was conducted using only specific diseases, there are difficulties in generalization. However, since the diseases are more common in Korean adults (Lee, 2005), it has significance in that the characteristics of Korea can be examined.

VI. Conclusion

The previous literatures on the health level of the region classify the regions mostly based on the classification of the urban, rural or metropolitan, urban, and rural areas based on administrative districts and analyze the health level among the regions. They have limitations in understanding Korean characteristics. Therefore, this study classified the whole region of Korea into five regions(fishing regions, service industry regions, aged rural regions, rural-urban integration regions and CBD) using the physical and industrial characteristics of the region. Health disparity analysis was performed with the prevalence of chronic diseases, obesity and depression according to the residence area by using KNHANES(2007-2014). Study showed the disparity in health status among regions despite the increase in the general health status of the population.

As a result of the study, it was found that there is a statistically significant difference in health level according to the residence area. Especially, the health level of all adults in aged rural regions was poorer than that of urban areas, but the health level was better than that of CBD. In addition, fishing regions were better in the prevalence of hyperlipidemia, diabetes and arthritis compared to urban areas and rural - urban integration regions were lower than urban areas in the prevalence of hyperlipidemia. In addition, the difference in these prevalence rates was also found in the low income class, and it became clearer. In conclusion, it was found that there is a difference in health level according to residence area of Korean adults in low income group.

This study has significance in classifying the regions using various regional characteristics. The results of the study showed that the disparity in health level among the residential area is different from the previous study in the US. This tendency may be due to the reason that reflects the characteristics of Korea where various population lived in a single administrative district. In addition, health disparity

was analyzed by this regional classification, being meaningful in the part where it is trying to understand the health related characteristics only in Korea different from the US.

Appendix 1

Table 10. Comparison between regional classification and urban-rural classification

Diseases	Fishing region			Service Industry region			Aged rural region			rural-urban integration region			Reference	Reference	rural		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI				OR	95% CI	
Hypertension	0.92	0.84	1.01	1.00	0.94	1.07	**0.82**	0.74	0.93	1.06	0.97	1.16	CBD	Urban	**0.88**	0.82	0.94
Hyperlipidemia	**0.88**	0.80	0.98	1.02	0.96	1.10	**0.67**	0.59	0.77	**0.90**	0.82	1.00			**0.78**	0.72	0.84
Diabetes	**0.82**	0.73	0.94	0.95	0.87	1.05	**0.86**	0.74	1.00	0.95	0.85	1.08			**0.86**	0.78	0.93
Cardiac Disease	1.11	0.89	1.41	1.14	0.96	1.37	**0.72**	0.54	0.98	0.92	0.73	1.18			**0.82**	0.68	0.96
Arthritis	**0.83**	0.74	0.94	1.00	0.92	1.10	**0.86**	0.75	0.99	0.96	0.85	1.08			**0.84**	0.76	0.91
Obesity	**1.09**	1.01	1.19	1.03	0.97	1.09	**0.85**	0.76	0.95	1.02	0.95	1.11			1.02	0.96	1.07
Depression	**0.71**	0.59	0.87	**0.87**	0.76	1.00	**0.70**	0.55	0.91	0.94	0.79	1.13			**0.77**	0.66	0.88

** bold number : $p<0.05$

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